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| APPLICATION NO.         | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-------------------------|-------------|----------------------|---------------------|------------------|
| 10/598,951              | 07/13/2007  | Shelley D. Minteer   | SLU 03-022 (4556.8) | 2480             |
| 321                     | 7590        | 03/20/2008           | EXAMINER            |                  |
| SENNIGER POWERS LLP     |             |                      | KALAFUT, STEPHEN J  |                  |
| ONE METROPOLITAN SQUARE |             |                      |                     |                  |
| 16TH FLOOR              |             |                      | ART UNIT            | PAPER NUMBER     |
| ST LOUIS, MO 63102      |             |                      | 1795                |                  |
|                         |             |                      |                     |                  |
|                         |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                         |             |                      | 03/20/2008          | ELECTRONIC       |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

[uspatents@senniger.com](mailto:uspatents@senniger.com)

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/598,951             | MINTEER ET AL.      |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | Stephen J. Kalafut     | 1795                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on \_\_\_\_.
- 2a) This action is **FINAL**.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1,2,4,7,11,13,14,17,34,38,45,48,51,53,61,62,64,66,68 and 70 is/are pending in the application.
  - 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) 61,62,64,66,68 and 70 is/are allowed.
- 6) Claim(s) 1,2,4,7,11,13,14,17,34,38,45,48,51 and 53 is/are rejected.
- 7) Claim(s) \_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.
 

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) All    b) Some \* c) None of:
    1. Certified copies of the priority documents have been received.
    2. Certified copies of the priority documents have been received in Application No. \_\_\_\_.
    3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

|   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | Paper No(s)/Mail Date. ____ .                                     |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>See Continuation Sheet</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application |
|   | 6) <input type="checkbox"/> Other: ____ .                         |

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :6 Feb 2007, 5 June 2007, 4 Jan 2007.

Claims 11, 34 and 38 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The antecedent of “the enzyme” in claim 11 is unclear, because there are two possible antecedent enzymes, one in each electrode. Likewise, the antecedent of “the enzyme immobilization materials” in claim 38 is unclear as to which electrode is intended. Claim 34 recites fuel flow rates, but how this method step affects the structure of the cell is unclear.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 46 and 51 are rejected under 35 U.S.C. 102(b) as being anticipated by Klitsner *et al.* (US 2002/0122972).

Klitsner *et al.* disclose an electrode that includes several legs, each one being an electron conductor, and having a width around 5 microns (paragraph 0050). As seen in figure 2a, the surface facing the electrolyte (70) is irregular and has a three-dimensional topography. It would thus inherently be able to induce convective fluid flow. Since the electrode includes carbon particles (62) and Nafion polymer (paragraph 0046), it would comprise a carbon-based ink.

Claims 1, 2, 4, 7, 11, 13, 17, 34 and 38 are rejected under 35 U.S.C. 102(e) as being anticipated by Minteer *et al.* (US 2005/0095466).

Minteer *et al.* discloses a biofuel cell (paragraph 0017) that includes a biocathode and bioanode that each include the presently recited materials, including electron conductors (paragraphs 0071-0075 and 0122), electron mediators (paragraphs 0077-0080 and 0124-0127), electrocatalysts (paragraphs 0082-0085 and 0129-0130), enzymes (paragraphs 0087-0088 and 0132-0135), and enzyme immobilization materials (paragraphs 0090-0108), such as those with a micellar or reverse micellar structure (paragraphs 0027, 0097-0099 and 0137). Regarding claim 34, the method step of moving the fluid(s) through the cell does not have any apparent affect on the structure of the cell, and is therefore not given patentable weight.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 48 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Klitsner *et al.*

Klitsner *et al.* do not disclose the electrode having a width between 10 and 50 microns, or having an effective surface area at least 1.5 greater than its geometric surface area. However, because of the size given for each conductive leg, determining an appropriate overall size for the electrode would be within the skill of the artisan. Determining an optimal surface area would

also be within the skill of the artisan, who would be familiar with the effect of surface area on reaction kinetics. For these reasons, these claims would be obvious over Klitsner *et al.*

Claims 1, 2, 4, 7, 11, 13, 17, 34 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Minteer *et al.* in view of Klitsner *et al.*

These claims differ from Minteer *et al.* by reciting an alternative embodiment in which at least one of the electrodes comprises a width less than 200 microns and a surface having an irregular three dimensional topography capable of inducing convective fluid flow. As noted above, Klitsner *et al.* discloses electrodes having such a geometry. Klitsner *et al.* also teaches their electrodes as useful for reacting not only hydrogen and air, but also alcohols and redox pairs, which would be liquid (paragraph 0087). Because the reactants of Minteer *et al.* also include oxygen, alcohols, and substances dissolved in a liquid (paragraph 0040), it would be obvious to use the electrode geometry of Klitsner *et al.* in the electrodes of Minteer *et al.*

Claims 61, 62, 64, 68 and 70 are allowed. The prior art cited herein or by applicants does not disclose a method of making an electrode, comprising forming an electrical conductor on a substrate, forming one or more microchannels in a non-conductive mold, adhering the mold to the substrate, flowing an electron conductor solution through the microchannels, and finally curing the solution.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The references cited on the International Search Report have been reviewed.

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Although indicated as "X", they do not disclose an electrode with a micellar or reverse micellar structure, or a width less than 200 microns and an irregular three-dimensional topography.

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen J. Kalafut whose telephone number is 571-272-1286. The examiner can normally be reached on Mon-Fri 8:00 am-4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Stephen J. Kalafut/  
Primary Examiner, Art Unit 1795